



Mill Brook

Watershed Summary

WATERSHED DESCRIPTION AND MAPS

The Mill Brook watershed covers an area of approximately 4,118 acres in the northern central area of Connecticut (Figure 1). There are several towns located at least partially in the watershed, including the municipalities of Bloomfield and Windsor, CT.

The Mill Brook watershed includes one segment addressed in this TMDL impaired for recreation due to elevated bacteria levels (CT4321-00_01). This segment was assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) list of impaired waterbodies. One segment in the watershed is currently unassessed as of the writing of this document. This does not suggest that there are no issues on these segments, but indicates a lack of current data to evaluate the segments as part of the assessment process. An excerpt of the Integrated Water Quality Report is included in Table 1 to show the status of the other waterbodies in the watershed (CTDEEP, 2010).

Mill Brook (CT4321-00_01) begins at the outlet of the Barber Pond Outlet dam, upstream of Old Windsor Road in Bloomfield on the Windsor-Bloomfield town line, flows south into Bloomfield before turning southeast and flowing into Windsor, flows east through Windsor, and ends at the confluence with the Farmington River downstream of the Palisado Avenue and railroad crossings in Windsor. The impaired segment is 4.56 miles long and is located within the Towns of Bloomfield and Windsor.

The impaired segment of Mill Brook has a water quality classification of A. Designated uses include potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. As there are no designated beaches in this segment of Mill Brook, the specific recreation impairment is for non-designated swimming and other water contact related activities.

Impaired Segment Facts

Impaired Segment:

Mill Brook (CT4321-00_01)

Municipalities: Windsor,
Bloomfield

Impaired Segment Length (miles):
4.56

Water Quality Classification:
Class A

Designated Use Impairment:
Recreation

Sub-regional Basin Name and Code: Mill Brook, 4321

Regional Basin: Farmington

Major Basin: Connecticut

Watershed Area (acres): 4,118

MS4 Applicable: Yes

Applicable Season: Recreation
Season (May 1 to September 30)

Figure 1: Watershed location in Connecticut

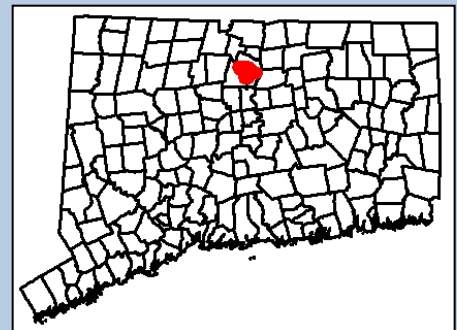
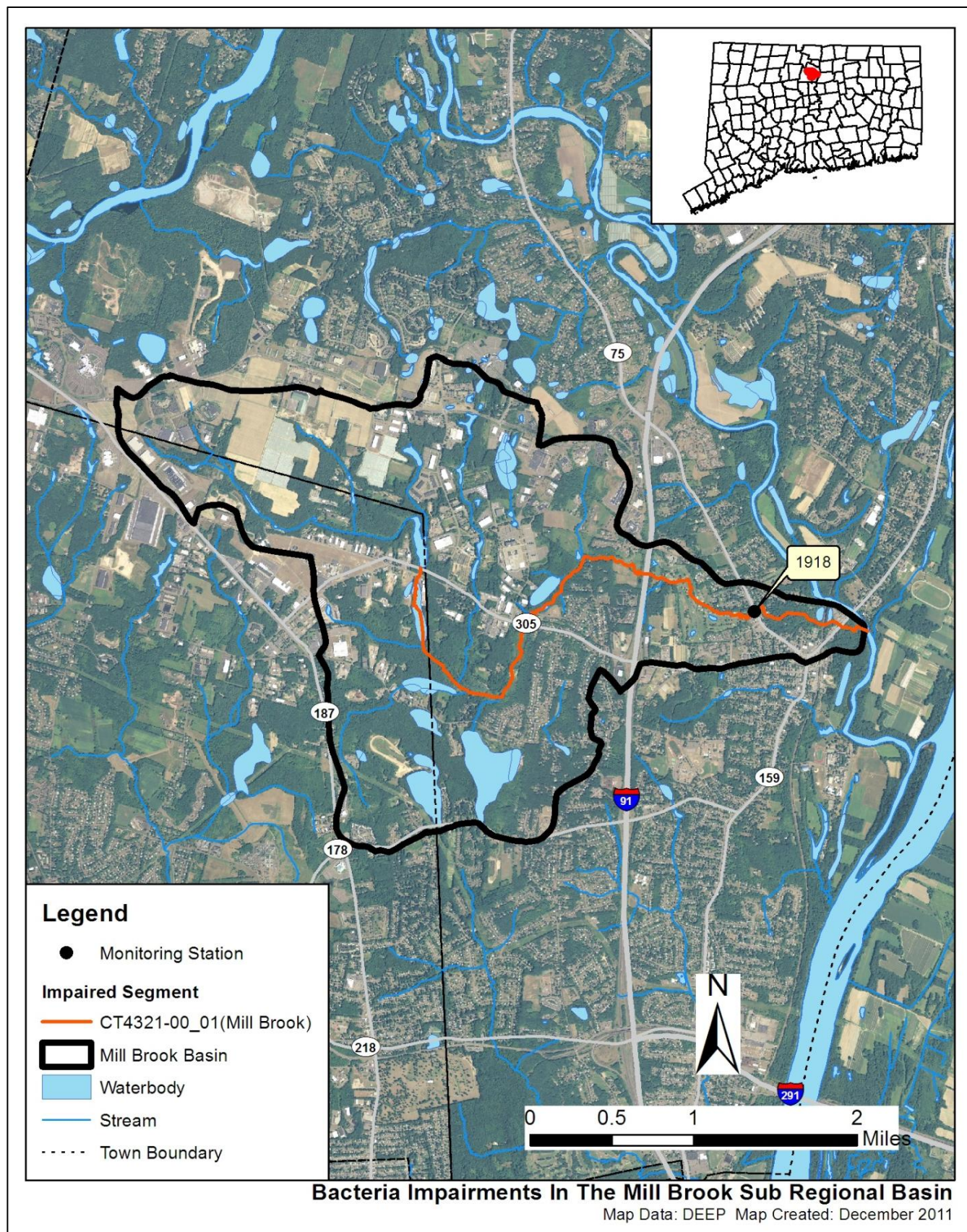


Table 1: Impaired segment and nearby waterbodies from the Connecticut 2010 Integrated Water Quality Report

Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation	Fish Consumption
CT4321-00_01	Mill Brook (Windsor)-01	From mouth at confluence with Farmington River (DS of Palisado Avenue and Rail Road crossings), Windsor, US to Barber Pond Outlet dam (just US of Old Winsor Road (Route 305) crossing), Bloomfield.	4.56	NOT	NOT	FULL
CT4321-00_02	Mill Brook (Bloomfield)-02	From Barber Pond INLET (near Windsor town line), Bloomfield, US to HW just US of Great Pond Drive crossing, Windsor.	1.96	U	U	FULL
Shaded cells indicate impaired segment addressed in this TMDL FULL = Designated Use Fully Supported NOT = Designated Use Not Supported U = Unassessed						

Figure 2: GIS map featuring general information of the Mill Brook watershed at the sub-regional level



Land Use

Existing land use can affect the water quality of waterbodies within a watershed (USEPA, 2011c). Natural processes, such as soil infiltration of stormwater and plant uptake of water and nutrients, can occur in undeveloped portions of the watershed. As impervious surfaces (such as rooftops, roads, and sidewalks) increase within the watershed landscape from commercial, residential, and industrial development, the amount of stormwater runoff to waterbodies also increases. These waterbodies are negatively affected as increased pollutants from nutrients and bacteria from failing and insufficient septic systems, oil and grease from automobiles, and sediment from construction activities become entrained in this runoff. Agricultural land use activities, such as fertilizer application and manure from livestock, can also increase pollutants in nearby waterbodies (USEPA, 2011c).

As shown in Figures 3 and 4, the Mill Brook watershed consists of 45% urban area, 32% forest, 18% agriculture, and 5% water. The majority of the land near the impaired segment is a mix of urban, forested, and agricultural land uses. There is some high density residential development near the brook off Mountain Road and Mill Brook Circle in Windsor. There are also large commercial areas near the brook, upstream of the impaired segment off Addison Road in Windsor and Bloomfield Road in Bloomfield. Large agricultural areas are located near the brook's impaired segment off Day Hill Road in Windsor.

Figure 3: Land use within the Mill Brook watershed

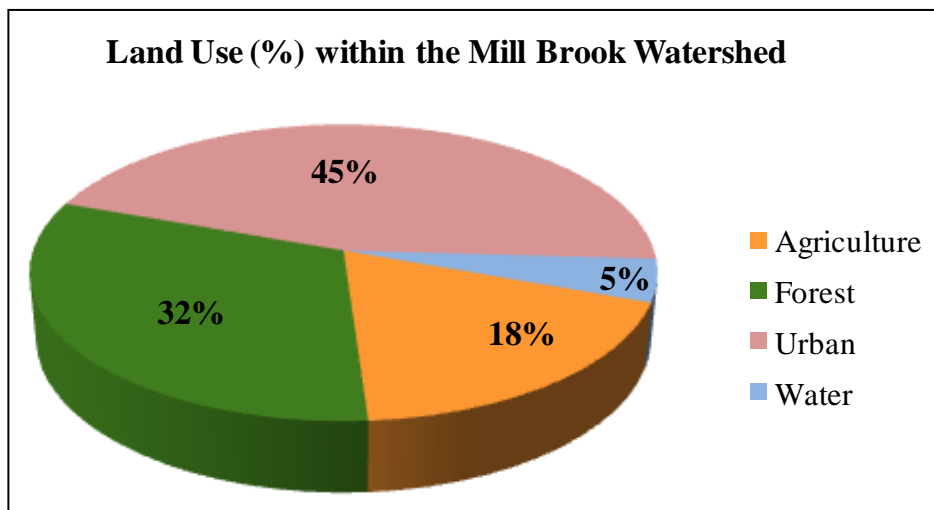
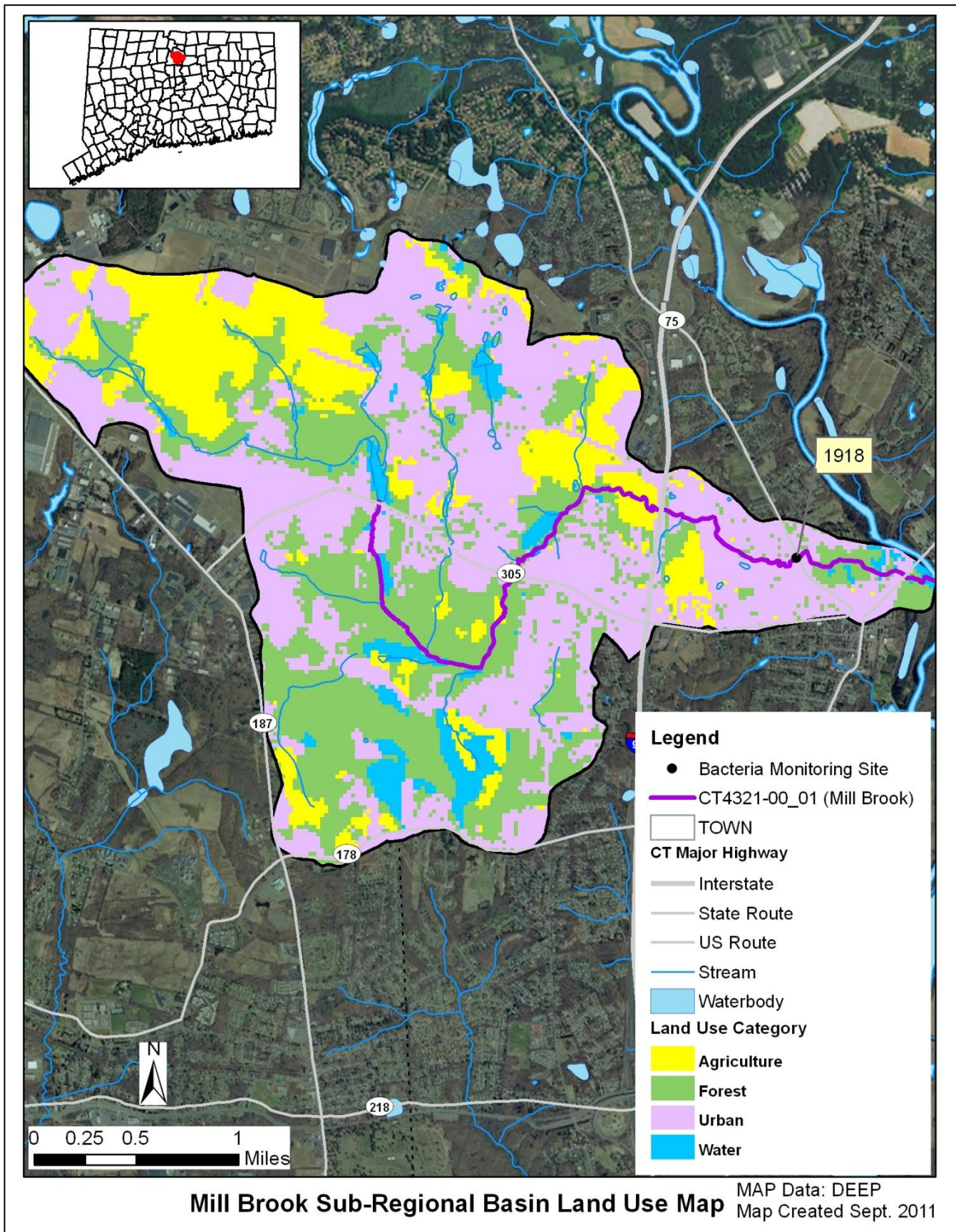


Figure 4: GIS map featuring land use for the Mill Brook watershed at the sub-regional level



WHY IS A TMDL NEEDED?

E. coli is the indicator bacteria used for comparison with the CT State criteria in the CT Water Quality Standards (WQS) (CTDEEP, 2011). All data results are from CT DEEP, USGS, Bureau of Aquaculture, or volunteer monitoring efforts at stations located on the impaired segments.

Table 2: Sampling station location description for the impaired segment in the Mill Brook watershed (stations organized downstream to upstream)

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT4321-00_01	Mill Brook	1918	Route 75 (#180)	Windsor	41.856886	-72.650097

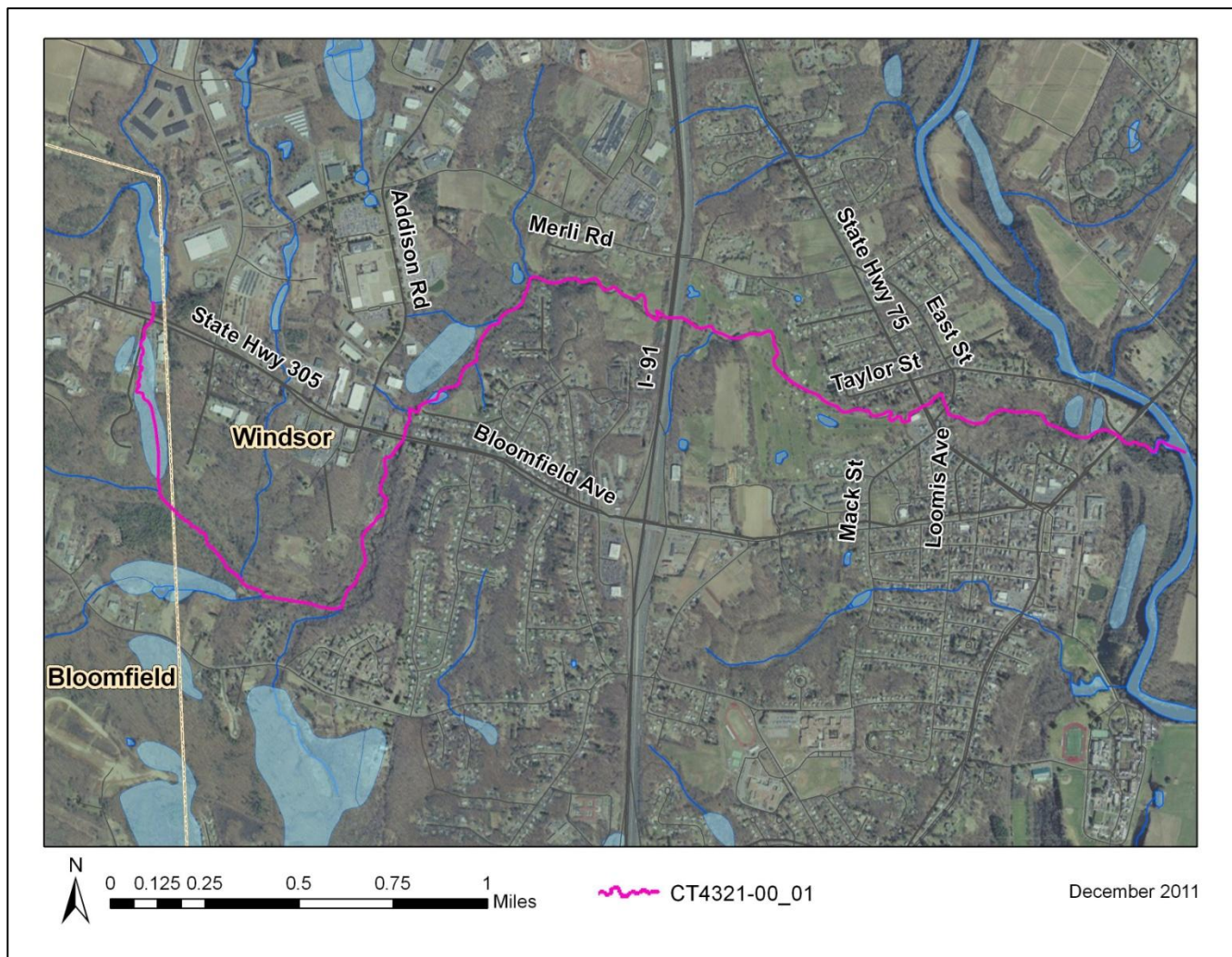
Mill Brook's impaired segment (CT4321-00_01) is a Class A freshwater river (Figure 5). Its applicable designated uses are potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. Water quality analyses were conducted using data from one sampling location, Station 1918, from 2009 (Table 2).

The water quality criteria for *E. coli*, along with bacteria sampling results from 2006-2009, are presented in Table 11. The annual geometric mean was calculated for Station 1918 and exceeded the WQS for *E. coli* in 2009. Single sample values at this station exceeded the WQS for *E. coli* on three out of seven sample dates in 2009.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for Station 1918 for wet-weather and dry-weather sampling days, where appropriate (Table 11). For Station 1918, the geometric mean during wet and dry-weather exceeded the WQS for *E. coli*. The geometric mean during dry-weather was twice the value of wet-weather for Station 1918.

Due to the elevated bacteria measurements presented in Table 11, this segment of the Mill Brook did not meet CT's bacteria WQS, was identified as impaired, and was placed on the CT List of Waterbodies Not Meeting Water Quality Standards, also known as the CT 303(d) Impaired Waters List. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all waterbodies to comply with State WQS.

Figure 5: Aerial map of the impaired segment of Mill Brook



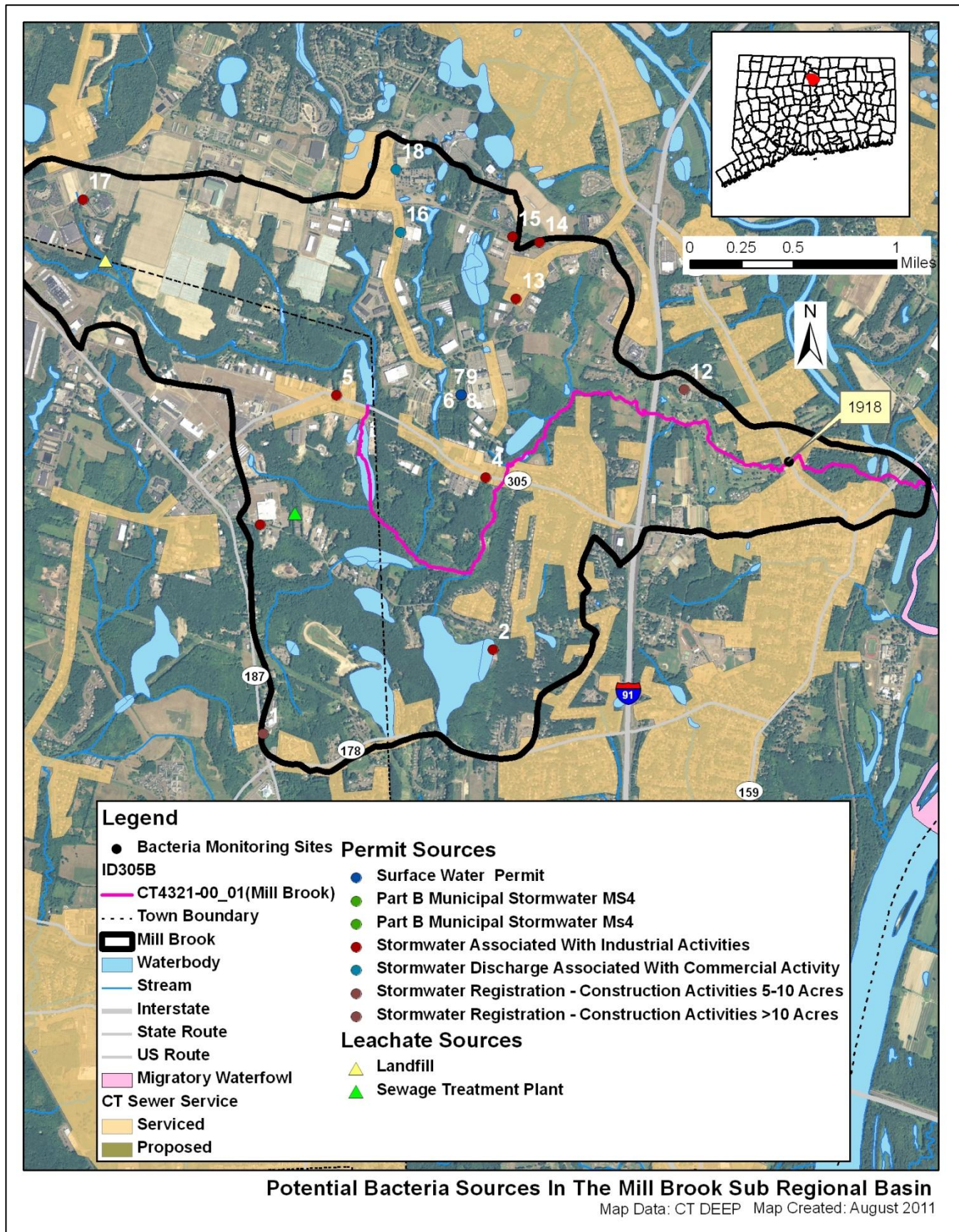
POTENTIAL BACTERIA SOURCES

Potential sources of indicator bacteria in a watershed include point and non-point sources, such as stormwater runoff, agriculture, sanitary sewer overflows (collection system failures), illicit discharges, and inappropriate discharges to the waterbody. Potential sources that have been tentatively identified in the watershed based on land use (Figures 3 and 4) and a collection of local information for the impaired waterbody is presented in Table 3 and Figure 6. However, the list of potential sources is general in nature and should not be considered comprehensive. There may be other sources not listed here that contribute to the observed water quality impairment in the study segments. Further monitoring and investigation will confirm listed sources and discover additional ones. Some segments in this watershed are currently listed as unassessed by CT DEEP procedures. This does not suggest that there are no potential issues on this segment, but indicates a lack of current data to evaluate the segment as part of the assessment process. For some segments, there are data from permitted sources, and CT DEEP recommends that any elevated concentrations found from those permitted sources be addressed through voluntary reduction measures. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement these TMDLs.

Table 3: Potential bacteria sources in the Mill Brook watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/Pets	Other
Mill Brook CT4321-00_01	x	x		x	x	x	x	

Figure 6: Potential sources in the Mill Brook watershed at the sub-regional level



The potential sources map for the impaired basin was developed after thorough analysis of available data sets. If information is not displayed in the map, then no sources were discovered during the analysis. The following is the list of potential sources that were evaluated: problems with migratory waterfowl, golf course locations, reservoirs, proposed and existing sewer service, cattle farms, poultry farms, permitted sources of bacteria loading (surface water discharge, MS4 permit, industrial stormwater, commercial stormwater, groundwater permits, and construction related stormwater), and leachate and discharge sources (agricultural waste, CSOs, failing septic systems, landfills, large septic tank leach fields, septage lagoons, sewage treatment plants, and water treatment or filter backwash).

Point Sources

Permitted sources within the watershed that could potentially contribute to the bacteria loading are identified in Table 4. This table includes permit types that may or may not be present in the impaired watershed. A list of active permits in the watershed is included in Table 5. Additional investigation and monitoring could reveal the presence of additional discharges in the watershed. Available effluent data from each of these permitted categories found within the watershed are compared to the CT State WQS for the appropriate receiving waterbody use and type.

Table 4: General categories list of other permitted discharges

Permit Code	Permit Description Type	Number in watershed
CT	Surface Water Discharges	1
GPL	Discharge of Swimming Pool Wastewater	0
GSC	Stormwater Discharge Associated with Commercial Activity	3
GSI	Stormwater Associated with Industrial Activity	9
GSM	Part B Municipal Stormwater MS4	2
GSN	Stormwater Registration – Construction	3
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	0

Permitted Sources

As shown in Table 5, there are multiple permitted discharges within the Mill Brook watershed. Bacteria data from 2001-2003 from several of these industrial permitted facilities are presented in Table 6 (where available). Though this data cannot be compared to a water quality standard as there is no recreation standard for fecal coliform bacteria, multiple samples were high, exceeding 1,000 colonies/100 mL, from Jacob's Vehicle Systems (GSI000465), Bass Planting Company (GSI000698) in Bloomfield, and TLD ACE Corporation (GSI000400) in Windsor. The reading of 100,000 colonies/100mL from TLD ACE Corporation in Windsor is extremely high.

Since the MS4 permits are not targeted to a specific location, but the geographic area of the regulated municipality, there is no one accurate location on the map to display the location of these permits. One dot will be displayed at the geographic center of the municipality as a reference point. Sometimes this location falls outside of the targeted watershed and therefore the MS4 permit will not be displayed in the

Potential Sources Map. Using the municipal border as a guideline will show which areas of an affected watershed are covered by an MS4 permit.

Table 5: Permitted facilities within the Mill Brook watershed

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Bloomfield	Jacobs Vehicle Systems Inc	GSI000465	Stormwater Associated With Industrial Activities	Jacobs Vehicle Systems, Inc	3
Bloomfield	Bass Plating Company	GSI000698	Stormwater Associated With Industrial Activities	Bass Plating Company, The	5
Bloomfield	Pds Engineering & Construction, Inc.	GSN001874	Stormwater Registration - Construction Activities 5-10 Acres	New Testament Church Of God Site Plan	1
Bloomfield	Town Of Bloomfield	GSM000035	Part B Municipal Stormwater MS4	Bloomfield, Town Of	NA
Windsor	Town Of Windsor	GSM000066	Part B Municipal Stormwater Ms4	Windsor, Town Of	NA (7)
Windsor	Spencer Turbine Co	GSI000399	Stormwater Associated With Industrial Activities	Spencer Turbine Company, The	14
Windsor	Permasteelisa North America Corp.	GSI001865	Stormwater Associated With Industrial Activities	Permasteelisa North America Corp.	15
Windsor	Emhart Glass Manufacturing Inc.	GSI002107	Stormwater Associated With Industrial Activities	Emhart Glass Research Center	17
Windsor	Tld Ace Corporation	GSI000400	Stormwater Associated With Industrial Activities	Tld Ace	4
Windsor	Windsor Sanitation, Inc.	GSI002232	Stormwater Associated With Industrial Activities	Windsor Sanitation Inc.	2
Windsor	Windsor - Stevens, Inc.	GSI000416	Stormwater Associated With Industrial Activities	Windsor-Stevens, Inc.	8
Windsor	Westinghouse Electric Company Llc	GSI002424	Stormwater Associated With Industrial Activities	Westinghouse Electric Company, Llc	13
Windsor	Chromalloy Connecticut	GSC000341	Stormwater Discharge Associated With Commercial Activity	Chromalloy Connecticut	16
Windsor	Konica Minolta Business Solutions U.S.A., Inc.	GSC000305	Stormwater Discharge Associated With Commercial Activity	Konica Minolta Business Solutions U.S.A., Inc.	18
Windsor	Windsor Shopping Center, Llp	GSC000084	Stormwater Discharge Associated With Commercial Activity	Windsor Shopping Center	9
Windsor	William B Meyer	GSN001907	Stormwater Registration - Construction Activities >10 Acres	Wm B.Meyer Moving & Storage Facility	10

Table 5: Permitted facilities within the Mill Brook watershed (continued)

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Windsor	Millbrook Greens, Llc	GSN001878	Stormwater Registration - Construction Activities >10 Acres	Millbrook Greens At Windsor	12
Windsor	Windsor - Stevens, Inc.	CT0003441	Surface Water Permit	Windsor-Stevens, Inc.	11

Table 6: Industrial permits in the Mill Brook watershed and available fecal coliform data (colonies/100mL). The results cannot be compared to the water quality standard as there is no recreation standard for fecal coliform.

Town	Location	Permit Number	Receiving Water	Sample Location	Sample Date	Result
Bloomfield	Jacobs Vehicle Systems	GSI465	Mill Brook Trib.	Outfall 001	08/31/01	>600
Bloomfield	Jacobs Vehicle Systems	GSI465	Mill Brook Trib.	Outfall 002	08/31/01	>600
Bloomfield	Jacobs Vehicle Systems	GSI465	Mill Brook Trib.	Outfall 001	06/12/02	>600
Bloomfield	Jacobs Vehicle Systems	GSI465	Mill Brook Trib.	Outfall 002	06/12/02	>600
Bloomfield	Jacobs Vehicle Systems	GSI465	Mill Brook Trib.	Outfall 002	07/09/03	>1000
Bloomfield	Jacobs Vehicle Systems	GSI465	Mill Brook Trib.	Outfall 001	07/09/03	>2000
Bloomfield	Bass Plating Company	GSI698	Mill Brook	outfall #1	07/17/01	4,700
Bloomfield	Bass Plating Company	GSI698	Mill Brook	outfall #1	02/27/02	10
Bloomfield	American Materials Corp	GSI898	Mill Brook	Outfall 01- Millbrook Common	12/19/01	50
Windsor	Spencer Turbine	GSI399	Mill Brook Watershed	North CB	08/20/02	420
Windsor	Spencer Turbine	GSI399	Mill Brook Watershed	North CB	07/10/03	10
Windsor	TLD ACE Corporation	GSI400	Mill Brook	outlet to Mill Brook	09/25/01	100,000
Windsor	TLD ACE Corporation	GSI400	Mill Brook	outlet to Mill Brook	12/20/02	230

Municipal Stormwater Permitted Sources

Per the EPA Phase II Stormwater rule all municipal storm sewer systems (MS4s) operators located within US Census Bureau Urbanized Areas (UAs) must be covered under MS4 permits regulated by the appropriate State agency. There is an EPA waiver process that municipalities can apply for to not participate in the MS4 program. In Connecticut, EPA has granted such waivers to 19 municipalities. All participating municipalities within UAs in Connecticut are currently regulated under MS4 permits by CT DEEP staff in the MS4 program.

The US Census Bureau defines a UA as a densely settled area that has a census population of at least 50,000. A UA generally consists of a geographic core of block groups or blocks that exceeds the 50,000 people threshold and has a population density of at least 1,000 people per square mile. The UA will also include adjacent block groups and blocks with at least 500 people per square mile. A UA consists of all or part of one or more incorporated places and/or census designated places, and may include additional territory outside of any place. (67 FR 11663)

For the 2000 Census a new geographic entity was created to supplement the UA blocks of land. This created a block known as an Urban Cluster (UC) and is slightly different than the UA. The definition of a UC is a densely settled area that has a census population of 2,500 to 49,999. A UC generally consists of a geographic core of block groups or blocks that have a population density of at least 1,000 people per square mile, and adjacent block groups and blocks with at least 500 people per square mile. A UC consists of all or part of one or more incorporated places and/or census designated places; such a place(s) together with adjacent territory; or territory outside of any place. The major difference is the total population cap of 49,999 people for a UC compared to >50,000 people for a UA. (67 FR 11663)

While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some municipalities that appear to be within an MS4 program that are not currently regulated through an MS4 permit. This oversight can explain a municipality that is at least partially shaded grey in the maps and there are no active MS4 reporting materials or information included in the appropriate appendix. While these areas are not technically in the MS4 permit program, they are still considered urban by the cluster definition above and are likely to contribute similar stormwater discharges to affected waterbodies covered in this TMDL.

As previously noted, EPA can grant a waiver to a municipality to preclude their inclusion in the MS4 permit program. One reason a waiver could be granted is a municipality with a total population less than 1000 people, even if the municipality was located in a UA. There are 19 municipalities in Connecticut that have received waivers, this list is: Andover, Bozrah, Canterbury, Coventry, East Hampton, Franklin, Haddam, Killingworth, Litchfield, Lyme, New Hartford, Plainfield, Preston, Salem, Sherman, Sprague, Stafford, Washington, and Woodstock. There will be no MS4 reporting documents from these towns even if they are displayed in an MS4 area in the maps of this document.

The list of US Census UCs is defined by geographic regions and is named for those regions, not necessarily by following municipal borders. In Connecticut the list of UCs includes blocks in the following Census Bureau regions: Colchester, Danielson, Lake Pocotopaug, Plainfield, Stafford, Storrs, Torrington, Willimantic, Winsted, and the border area with Westerly, RI (67 FR 11663). Any MS4 maps showing these municipalities may show grey areas that are not currently regulated by the CT DEEP MS4 permit program.

The impaired segment of Mill Brook is located within the Towns of Bloomfield and Windsor. Both towns have designated urban areas within the Mill Brook watershed, as defined by the U.S. Census Bureau. Therefore, Bloomfield and Windsor are required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by CT DEEP (Figure 7). This general permit is only applicable to municipalities that are identified in Appendix A of the MS4 permit that contain designated urban areas and discharge stormwater via a separate storm sewer system to surface waters of the State. The permit required municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants as well as to protect water quality. The MS4 permit is discussed further in the “TMDL Implementation Guidance” section of the core TMDL document. Additional information regarding stormwater management and the MS4 permit can be obtained on CTDEEP’s website

(http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325702&depNav_GID=1654).

Figure 7: MS4 areas of the Mill Brook watershed

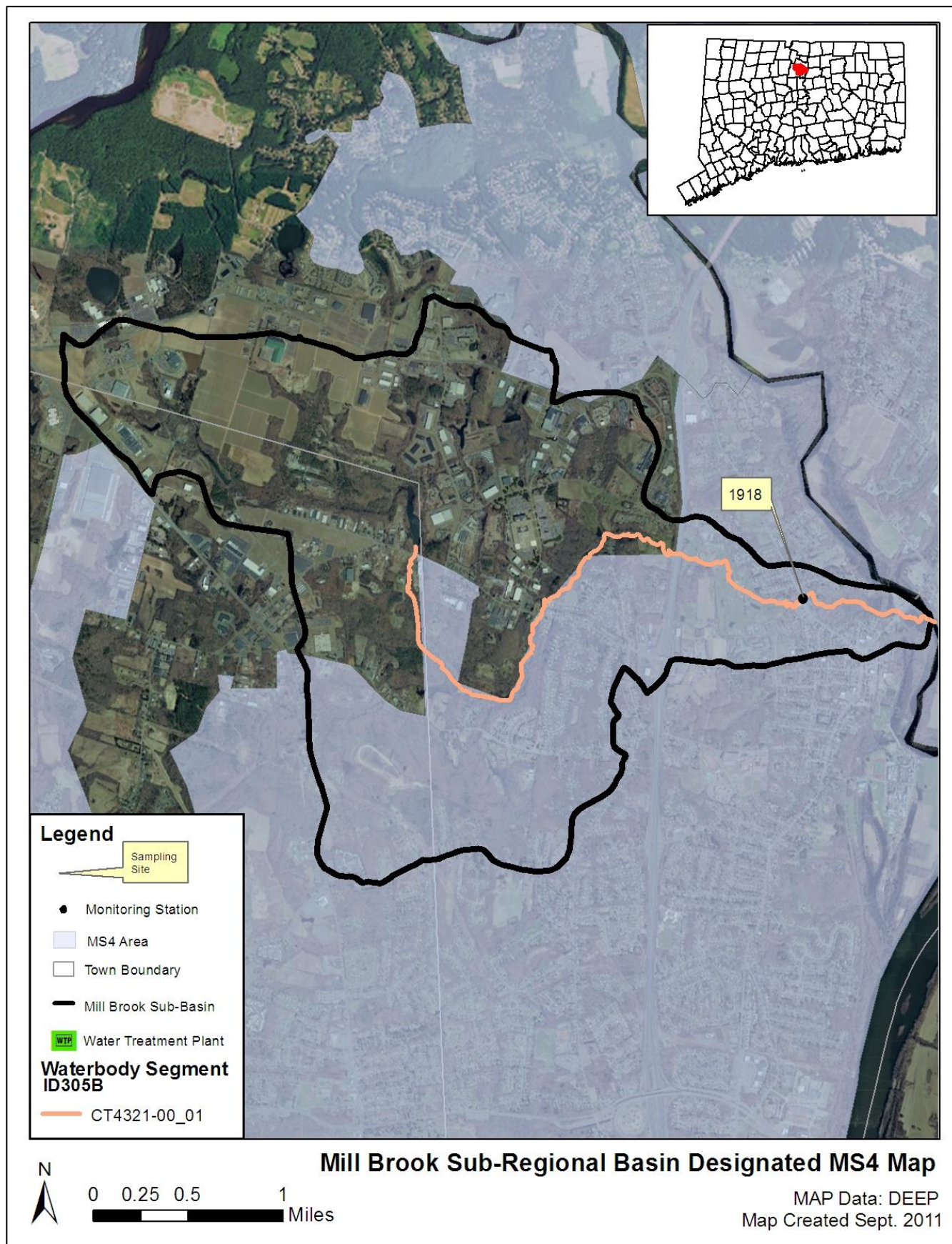


Table 7 displays sample results for *E. coli* from several MS4 discharges within the Mill Brook watershed from the Towns of Bloomfield and Windsor. Bloomfield had one outfall sampled with a total of four samples. One out of four (25%) samples from Bloomfield exceeded the single sample WQS for *E. coli*. Windsor had four outfalls sampled with a total of 20 samples. Six out of 20 (30%) samples from Windsor exceeded the single sample WQS for *E. coli*. These results indicate that the MS4 discharges from Bloomfield and Windsor are a potential source of bacterial contamination to Mill Brook.

Table 7: MS4 permits in the Mill River watershed with *E. coli* Sample results

Town	Location	MS4 Type	Receiving Waters	Sample Date	Result
Bloomfield	I-2 East Dudley Town Road	Industrial	Mill Brook	12/01/04	40
Bloomfield	I-2 East Dudley Town Road	Industrial	Mill Brook	11/09/05	30
Bloomfield	I-2 East Dudley Town Road	Industrial	Mill Brook	10/17/06	280
Bloomfield	I-2 East Dudley Town Road	Industrial	Mill Brook	11/25/08	2,300
Windsor	555 Day Hill Rd #4	Commercial	Mill Brook	12/01/06	>2000
Windsor	555 Day Hill Rd #4	Commercial	Mill Brook	04/12/07	100
Windsor	555 Day Hill Rd #4	Commercial	Mill Brook	11/26/07	90
Windsor	555 Day Hill Rd #4	Commercial	Mill Brook	09/26/08	480
Windsor	555 Day Hill Rd #4	Commercial	Mill Brook	06/09/09	200
Windsor	555 Day Hill Rd #4	Commercial	Mill Brook	08/25/11	280
Windsor	615 Day Hill Rd #3	Industrial	Mill Brook	12/01/06	>2000
Windsor	615 Day Hill Rd #3	Industrial	Mill Brook	04/12/07	160
Windsor	615 Day Hill Rd #3	Industrial	Mill Brook	11/26/07	50
Windsor	615 Day Hill Rd #3	Industrial	Mill Brook	09/26/08	360
Windsor	615 Day Hill Rd #3	Industrial	Mill Brook	06/09/09	1,780
Windsor	615 Day Hill Rd #3	Industrial	Mill Brook	08/25/11	3,040
Windsor	800 Marshall Phelps #5	Industrial	Mill Brook	12/01/06	320
Windsor	800 Marshall Phelps #5	Industrial	Mill Brook	04/12/07	20
Windsor	800 Marshall Phelps #5	Industrial	Mill Brook	11/26/07	80
Windsor	800 Marshall Phelps #5	Industrial	Mill Brook	09/26/08	100
Windsor	800 Marshall Phelps #5	Industrial	Mill Brook	06/09/09	250
Windsor	800 Marshall Phelps #5	Industrial	Mill Brook	08/25/11	20
Windsor	Day Hill Rd Commercial 2	Commercial	Trib to Mill Brook	12/01/04	>600
Windsor	Marshall Phelps Industrial 1	Industrial	Trib to Mill Brook	12/01/04	10

Shaded cells indicate an exceedance of single-sample based water quality criteria (410 colonies/100 mL)

Non-point Sources

Non-point source pollution (NPS) comes from many diffuse sources and is more difficult to identify and control. NPS pollution is often associated with land-use practices. Examples of NPS that can contribute bacteria to surface waters include insufficient septic systems, pet and wildlife waste, agriculture, and contact recreation (swimming or wading). Potential sources of NPS within the Mill Brook watershed are described below.

Stormwater Runoff from Developed Areas

Approximately 45% of the watershed is considered urban, and much of that area is concentrated around the impaired segment in Windsor (Figures 4 and 9). Urban areas are often characterized by impervious cover, or surface areas such as roofs and roads that force water to run off land surfaces rather than infiltrate into the soil. Studies have shown a link between increasing impervious cover and degrading water quality conditions in a watershed (CWP, 2003). In one study, researchers correlated the amount of fecal coliform to the percent of impervious cover in a watershed (Mallin *et al.*, 2000).

Approximately 35% of the Mill Brook watershed is characterized by 0 to 6% impervious cover, while 45% is 7 to 11% impervious cover, and 20% is 12 to 15% impervious cover (Figures 8 and 9). There are several commercial developments with large areas of impervious surfaces in proximity to Mill Brook in both Bloomfield and Windsor. The portion of I-91 in Windsor, near the downstream reaches of Mill Brook's impaired segment, has large areas of impervious surfaces that drain to the brook. The amount and proximity of impervious surfaces to Mill Brook indicate that stormwater runoff from developed areas are a potential source of bacterial contamination.

Figure 8: Range of impervious cover (%) in the Mill Brook watershed

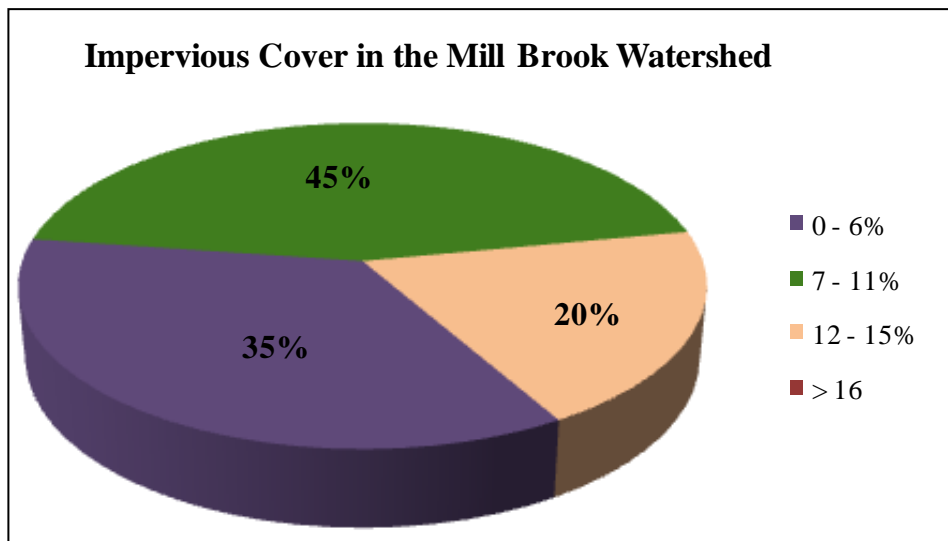
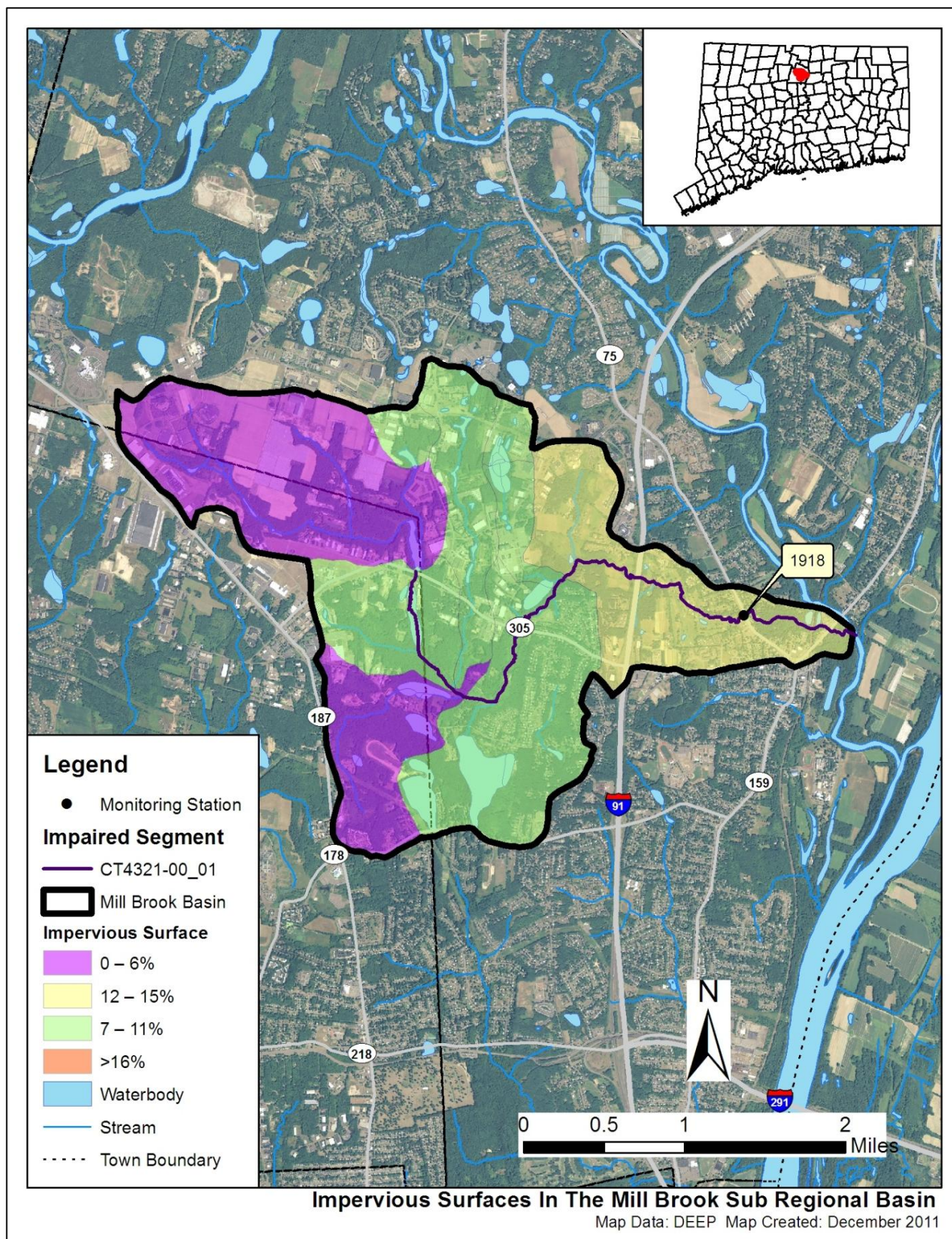


Figure 9: Impervious cover (%) for the Mill Brook sub-regional watershed



Agricultural Activities

Agricultural operations are an important economic activity and landscape feature in many areas of the State. Runoff from agricultural fields may contain pollutants such as bacteria and nutrients (USEPA, 2011a). This runoff can include pollutants from farm practices such as storing manure, allowing livestock to wade in nearby waterbodies, applying fertilizer, and reducing the width of vegetated buffer along the shoreline. Agricultural land use makes up 18% of the Mill Brook watershed. There are several areas where agricultural land is near the impaired segment of Mill Brook and its tributaries. There is a large agricultural operation upstream of the impaired segment off Day Hill Road and Great Pond Drive in Windsor. There is also a large agricultural area along a tributary to the impaired segment off Old Day Hill Road in Windsor. Agricultural areas near the impaired segment and its tributaries are potentially carrying pollutants, including bacteria, into Mill Brook.

Insufficient Septic Systems and Illicit Discharges

As shown in Figure 6, portions of the watershed are serviced by sanitary sewers. Households and businesses in the non-serviced areas of the watershed must rely on onsite wastewater treatment systems, such as septic systems. Given the number of septic systems in the area, there may be failed septic systems in the watershed that are currently undetected. Insufficient or failing septic systems can be significant sources of bacteria by allowing raw waste to reach surface waters. In Connecticut, local health directors or health districts are responsible for keeping track of any reported insufficient or failing septic systems in a specific municipality. The Town of Windsor has its own health department (www.townofwindsorct.com/health/). The Town of Bloomfield does not have its own health department, but is a part of the West Hartford-Bloomfield Health District (www.westhartford.org/living_here/town_departments/health_district/index.php).

Areas in the eastern and central portion of the watershed surrounding the impaired segment of Mill Brook are serviced by the municipal sewer system (Figure 6). Sewer system leaks and other illicit discharges can contribute bacteria to nearby surface waters.

Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Mill Brook watershed represent another potential source of bacteria. With the construction of roads and drainage systems, these wastes may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface water. These physical land alterations can exacerbate the impact of natural sources on water quality (USEPA, 2001).

Geese and other waterfowl are known to congregate in open areas including recreational fields, golf courses, agricultural crop fields, and ponds. The Mill Brook Golf Course is located near the downstream terminus of the impaired segment east of I-91 in Windsor. There is also Trent Park located off Trent Drive in Windsor. These areas have large turf areas in proximity to the brook's impaired segment. In addition to creating a nuisance, large numbers of geese can also create unsanitary conditions on the grassed areas and ponds and cause water quality problems due to bacterial contamination associated with their droppings. Large populations of geese can also lead to habitat destruction as a result of overgrazing on wetland and riparian plants. These factors make wildlife waste a potential source of bacteria to Mill Brook.

Also, urban development surrounds portions of the impaired segment (Figure 5). When not properly disposed, waste from domestic animals such as dogs, can enter surface waters directly or through stormwater infrastructure. Therefore, domestic animal waste may also be contributing to bacteria concentrations in Mill Brook.

Additional Sources

There may be other sources not listed here or identified in Figure 6 that contribute to the observed water quality impairment in Mill Brook. Further monitoring and investigation will confirm the listed sources and discover additional ones. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement this TMDL.

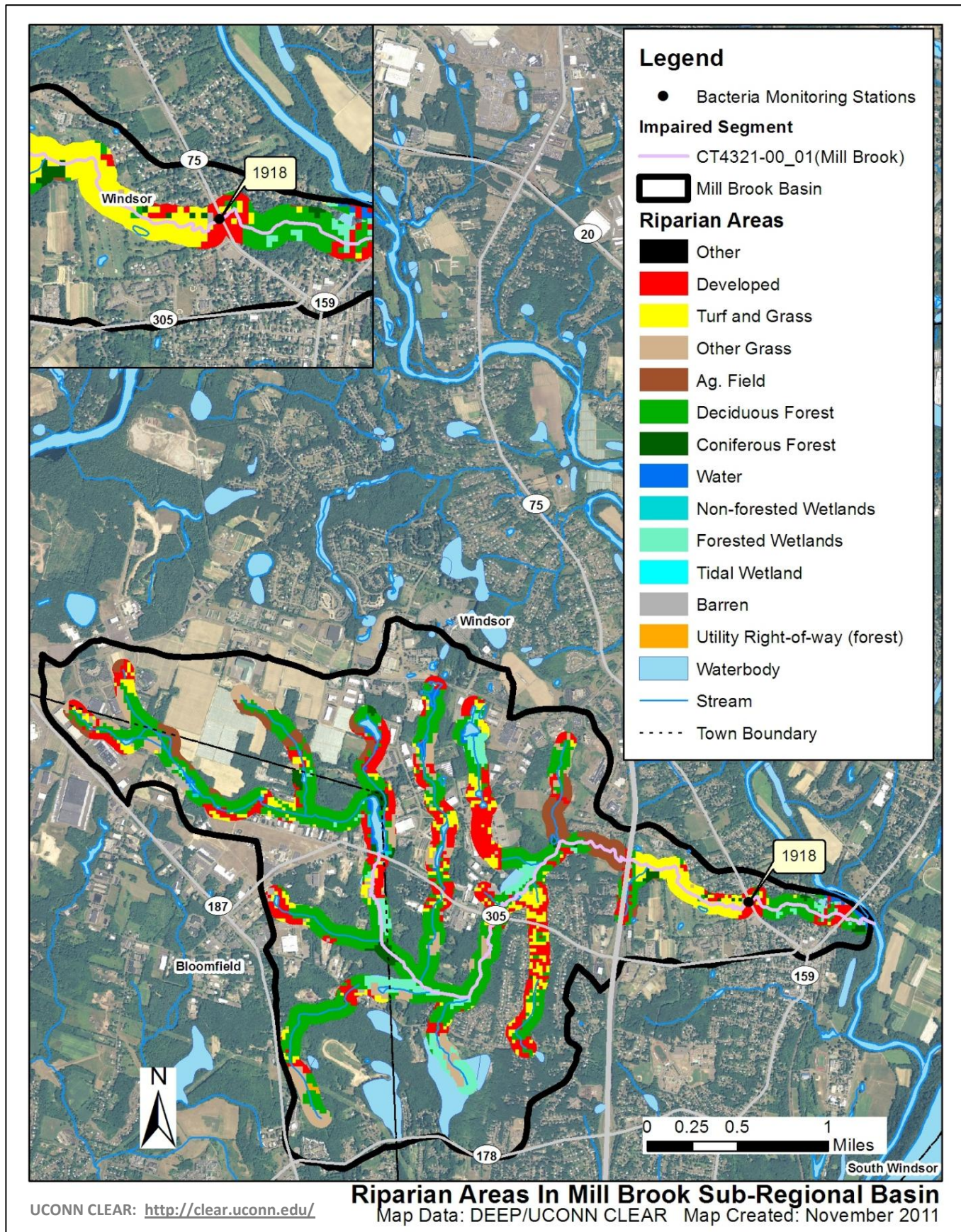
Land Use/Landscape***Riparian Buffer Zones***

The riparian buffer zone is the area of land located immediately adjacent to streams, lakes, or other surface waters. The boundary of the riparian zone and the adjoining uplands is gradual and not always well-defined. However, riparian zones differ from uplands because of high levels of soil moisture, frequent flooding, and the unique assemblage of plant and animal communities found there. Through the interaction of their soils, hydrology, and vegetation, natural riparian areas influence water quality as contaminants are taken up into plant tissues, adsorbed onto soil particles, or modified by soil organisms. Any change to the natural riparian buffer zone can reduce the effectiveness of the natural buffer and has the potential to contribute to water quality impairment (USEPA, 2011b).

The CLEAR program at UCONN has created streamside buffer layers for the entire State of Connecticut (<http://clear.uconn.edu/>), which have been used in this TMDL. Analyzing this information can reveal potential sources and implementation opportunities at a localized level. The land use directly adjacent to a waterbody can have direct impacts on water quality from surface runoff sources.

The majority of the riparian zone for the impaired segment of Mill Brook is characterized by forested land use. However, there are many areas with development, agriculture, and turf grass land uses within the riparian zone of Mill Brook's impaired segment and the riparian zones for its tributaries (Figure 10). As previously mentioned, developed, agricultural, and turf (such as golf course) areas are potential sources of bacterial contamination.

Figure 10: Riparian buffer zone information for the Mill Brook watershed



CURRENT MANAGEMENT ACTIVITIES

The Towns of Bloomfield and Windsor have developed and implemented programs to protect water quality from bacterial contamination. As indicated previously, the portion of the watershed surrounding the impaired segment is regulated under the MS4 program. The MS4 General Permit is required for any municipality with urbanized areas that initiates, creates, originates or maintains any discharge of stormwater from a storm sewer system to waters of the State. The MS4 permit requires towns to design a Stormwater Management Plan (SMP) to reduce the discharge of pollutants in stormwater to improve water quality. The plan must address the following 6 minimum measures:

1. Public Education and Outreach.
2. Public Involvement/Participation.
3. Illicit discharge detection and elimination.
4. Construction site stormwater runoff control.
5. Post-construction stormwater management in the new development and redevelopment.
6. Pollution prevention/good housekeeping for municipal operations.

Each municipality is also required to submit an annual update outlining the steps they are taking to meet the six minimum measures. All updates that address bacterial contamination in the watershed are summarized in Tables 8 and 9.

Table 8: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Bloomfield, CT (Permit # GSM000035)

Minimum Measure	Bloomfield 2006 Annual Report
Public Outreach and Education	1) Posted EPA brochure <i>After the Storm, A Citizen's Guide to Understanding Stormwater</i> to web page. 6th grade students handed out brochures to homeowners explaining their storm drain stenciling project in the Kenwood Circle neighborhood.
	2) Sponsored HazWaste Collection Day twice in 2006.
Public Involvement and Participation	1) Held open meetings with the Stormwater Committee.
Illicit Discharge Detection and Elimination	1) Completed inspection and mapping of all town outfalls greater than 12 inches.
	2) Conducted wet weather sampling and analysis at six outfalls.
Construction Site Stormwater Runoff Control	1) Will perform inspections of all construction sites at least once per month, and also after heavy rains, and will perform follow-up inspections to ensure that problems are resolved promptly.
Post Construction Stormwater Management	1) Reviewed land use permit applications for post-construction stormwater quality BMPs for all major town projects.
Pollution Prevention and Good Housekeeping	1) Continued to sweep all streets at least once per year and identify areas that may require sweeping more than once per year.
	2) Cleaned 800 catch basins in 2005 and 2006 or roughly 50% of the estimated total number of catch basins in town.

Table 9: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Windsor, CT (Permit # GSM000066)

Minimum Measure	Windsor 2010 Annual Report Update
Public Outreach and Education	1) A variety of media outlets were used to provide stormwater management information to Windsor residents including newspaper publications and broadcasts on Windsor's Government Access Television Channel.
Public Involvement and Participation	1) The Environmental Planner conducted two community clean-ups in 2010.
Illicit Discharge Detection and Elimination	1) An Illicit Discharges and Connections Ordinance was adopted by Town Council on April 6, 2009.
Construction Site Stormwater Runoff Control	No updates
Post Construction Stormwater management	1) The Town adopted a Stormwater Management Ordinance in 2009.
Pollution Prevention and Good Housekeeping	1) Town employees received stormwater training in 2010 2) All Town roadways were swept at least once in the past year. 3) Approximately 1500 catch basins were cleaned in 2010

RECOMMENDED NEXT STEPS

As shown above, the Towns of Bloomfield and Windsor have developed programs to protect water quality from pollutants, including bacterial contamination. Future mitigative activities are necessary to ensure the long-term protection of the impaired segment of Mill Brook and have been prioritized below.

1) Identify areas along Mill Brook to implement Best Management Practices (BMPs) to control stormwater runoff.

Since 45% of the watershed is considered urban and developed areas are located near the impaired segment, stormwater runoff is likely contributing bacteria to the waterbody. Bloomfield has already conducted wet-weather at six outfalls. To identify specific areas that are contributing bacteria to the impaired segment, the towns should continue to conduct wet-weather sampling at stormwater outfalls that discharge directly to Mill Brook. To treat stormwater runoff, the towns should also identify areas along the more developed sections of Mill Brook, particularly along the impaired segment, to install BMPs that encourage stormwater to infiltrate into the ground before entering Mill Brook. These BMPs would disconnect impervious areas and reduce pollutant loads to the river. More detailed information and BMP recommendations can be found in the core TMDL document.

2) Continue monitoring permitted sources.

Previous sampling from discharges at Jacobs Vehicle Systems, Bass Planting Company, and TLD ACE Corporation has shown elevated levels of fecal coliform bacteria, an indicator of bacterial pollution (Table 6). Further monitoring will provide information essential to better locate, understand, and reduce pollution sources. If any current monitoring is not done with appropriate bacterial indicator based on the receiving water, then a recommended change during the next permit reissuance is to include the appropriate indicator species. If facility monitoring indicates elevated bacteria, then implementation of permit required, and voluntary measures to identify and reduce sources of bacterial contamination at the facility are an additional recommendation. Regular monitoring should be established for all permitted sources to ensure compliance with permit requirements and to determine if current requirements are adequate or if additional measures are necessary for water quality protection.

Section 6(k) of the MS4 General Permit requires a municipality to modify their Stormwater Management Plan to implement the TMDL within four months of TMDL approval by EPA if stormwater within the municipality contributes pollutant(s) in excess of the allocation established by the TMDL. For discharges to impaired waterbodies, the municipality must assess and modify the six minimum measures of its plan, if necessary, to meet TMDL standards. Particular focus should be placed on the following plan components: public education, illicit discharge detection and elimination, stormwater structures cleaning, and the repair, upgrade, or retrofit of storm sewer structures. The goal of these modifications is to establish a program that improves water quality consistent with TMDL requirements. Modifications to the Stormwater Management Plan in response to TMDL development should be submitted to the Stormwater Program of DEEP for review and approval.

Table 10 details the appropriate bacteria criteria for use as waste load allocations established by this TMDL for use as water quality targets by permittees as permits are renewed and updated, within the Mill Brook watershed.

For any municipality subject to an MS4 permit and affected by a TMDL, the permit requires a modification of the SMP to include BMPs that address the included impairment. In the case of bacteria related impairments municipal BMPs could include: implementation or improvement to existing nuisance wildlife programs, septic system monitoring programs, any additional measures that can be added to the required illicit discharge detection and elimination (IDDE) programs, and increased street sweeping above basic permit requirements. Any non-MS4 municipalities can implement these same types of initiatives in effort to reduce bacteria source loading to impaired waterways.

Any facilities that discharge non-MS4 regulated stormwater should update their Pollution Prevention Plan to reflect BMPs that can reduce bacteria loading to the receiving waterway. These BMPs could include nuisance wildlife control programs and any installations that increase surface infiltration to reduce overall stormwater volumes. Facilities that are regulated under the Commercial Activities Stormwater Permit should report any updates to their SMP in their summary documentation submitted to DEEP.

Table 10. Bacteria (e.coli) TMDLs, WLAs, and LAs for Recreational Use

Class	Bacteria Source	Instantaneous <i>E. coli</i> (#/100mL)						Geometric Mean <i>E. coli</i> (#/100mL)	
		WLA ⁶			LA ⁶			WLA ⁶	LA ⁶
	Recreational Use	1	2	3	1	2	3	All	All
A	Non-Stormwater NPDES	0	0	0				0	
	CSOs	0	0	0				0	
	SSOs	0	0	0				0	
	Illicit sewer connection	0	0	0				0	
	Leaking sewer lines	0	0	0				0	
	Stormwater (MS4s)	235 ⁷	410 ⁷	576 ⁷				126 ⁷	
	Stormwater (non-MS4)				235 ⁷	410 ⁷	576 ⁷		126 ⁷
	Wildlife direct discharge				235 ⁷	410 ⁷	576 ⁷		126 ⁷
	Human or domestic animal direct discharge ⁵				235	410	576		126

- (1) **Designated Swimming.** Procedures for monitoring and closure of bathing areas by State and Local Health Authorities are specified in: Guidelines for Monitoring Bathing Waters and Closure Protocol, adopted jointly by the Department of Environmental Protections and the Department of Public Health. May 1989. Revised April 2003 and updated December 2008.
- (2) **Non-Designated Swimming.** Includes areas otherwise suitable for swimming but which have not been designated by State or Local authorities as bathing areas, waters which support tubing, water skiing, or other recreational activities where full body contact is likely.
- (3) **All Other Recreational Uses.**
- (4) Criteria for the protection of recreational uses in Class B waters do not apply when disinfection of sewage treatment plant effluents is not required consistent with Standard 23. (Class B surface waters located north of Interstate Highway I-95 and downstream of a sewage treatment plant providing seasonal disinfection May 1 through October 1, as authorized by the Commissioner.)
- (5) Human direct discharge = swimmers
- (6) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations
- (7) Replace numeric value with "natural levels" if only source is naturally occurring wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011a). Sections 2.2.2 and 6.2.7 of this Core Document deal with BMPs and delineating type of wildlife inputs.

3) Ensure there are sufficient buffers on agricultural lands along Mill Brook.

If not already in place, agricultural producers should work with the CT Department of Agriculture and the U.S. Department of Agriculture Natural Resources Conservation Service to develop conservation plans for their farming activities within the watershed. These plans should focus on ensuring that there are sufficient stream buffers, that fencing exists to restrict livestock and horse access to streams and wetlands, and that animal waste handling, disposal, and other appropriate Best Management Practices (BMPs) are in place. Particular attention should be paid to those agricultural operations located along the impaired segment and along tributary streams of the impaired segment.

4) Implement a program to evaluate the sanitary sewer system.

Portions of the Mill River watershed rely on a sanitary sewer system (Figure 6). Ensuring there are no leaks or overflows from the sanitary sewer in this area should be made a priority. Bloomfield has already begun mapping all stormwater outfalls greater than 12 inches diameter, and Windsor has adopted an illicit discharge detection and elimination program. It is important for Bloomfield and Windsor to continue to develop a program to evaluate their sanitary sewer and reduce leaks and overflows, especially in the areas near Mill Brook's impaired segment. This program should include periodic inspections of the sewer line.

5) Develop a system to monitor septic systems.

Some residents in the watershed rely on septic systems (Figure 6). If not already in place, Bloomfield and Windsor should establish a program to ensure that existing septic systems are properly operated and maintained. For instance, communities can create an inventory of existing septic systems through mandatory inspections. Inspections help encourage proper maintenance and identify failed and sub-standard systems. Policies that govern the eventual replacement of the sub-standard systems within a reasonable timeframe could also be adopted. Towns can also develop programs to assist citizens with the replacement and repair of older and failing systems.

6) Evaluate municipal education and outreach programs regarding animal waste.

Bloomfield and Windsor can take measures to minimize waterfowl-related impacts such as encouraging residents and businesses to allow tall, coarse vegetation to grow in the riparian areas of the impaired segment of Mill Brook that are frequented by waterfowl, particularly within parks. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shoreline will make the habitat less desirable to geese and encourage migration. In addition, any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairments in the Mill Brook watershed and can harm human health and the environment.

Animal wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of animal waste on water quality include installing signage, providing pet waste receptacles in high-uses areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas.

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 11: Mill Brook Bacteria Data

Waterbody ID: CT4321-00_01*Characteristics:* Freshwater, Class A, Potential Drinking Water Source, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply*Impairment:* Recreation (*E. coli* bacteria)*Water Quality Criteria for E. coli:*

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: 63%

Single Sample: 26%

Data: 2009 from CT DEEP targeted sampling efforts, 2012 TMDL CycleSingle sample *E. coli* (colonies/100 mL) data from Station 1918 on Mill Brook with annual geometric means calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1918	At Route 75 crossing (#180)	6/1/2009	233	dry	345* (63%)
1918	At Route 75 crossing (#180)	6/15/2009	520	wet	
1918	At Route 75 crossing (#180)	6/29/2009	301	dry	
1918	At Route 75 crossing (#180)	7/13/2009	556* (26%)	dry	
1918	At Route 75 crossing (#180)	7/27/2009	538	wet	
1918	At Route 75 crossing (#180)	8/10/2009	173	dry	
1918	At Route 75 crossing (#180)	8/24/2009	309	wet	

Shaded cells indicate an exceedance of water quality criteria

*Indicates single sample and geometric mean values used to calculate the percent reduction

Wet and dry weather geometric mean values for Station 1918 on Mill Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
1918	At Route 75 crossing (#180)	2009	3	4	345	442	287

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gage at the Hartford Bradley International Airport

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